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THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

DEVELOPMENT OF A MOON-BASED MAGNETOSPHERIC AND CORONAL
IMAGER USING A LARGE BROADBAND ARRAY

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I. THE LUNAR BASED SOUNDER AND RADIO TELESCOPE

The "Missions to and from Planet Earth" mandated by President Bush in 1989 provide a unique opportunity for magnetospheric and coronal plasma physicists to cooperate with low frequency radio astronomers in the development of an advanced experiment designed for the lunar surface. A large active lunar based array would sound the Earth's magnetosphere at VLF frequencies and the solar corona at decametric wavelengths allowing plasma physicists to map both the Earth's magnetosphere and those regions in the solar corona that trigger precursors to solar flares. With the transmitter silent, the array would become the ideal low frequency radio telescope, examining both geospace emissions such as auroral kilometric radiation and extraterrestrial signals from the planets, pulsars, supernova remnants, and active galactic nuclei. Both experiments satisfy requirements mandated in both "Mission to Planet Earth" and in "Mission from Planet Earth." By proposing a cooperative effort both communities (plasma physicists and radio astronomers) stand to benefit.

Jim Green, Director of the NASA Space Science Data Center (NSSDC) at GSFC; Tony Phillips, Research Fellow at California Institute of Technology; T.D. Carr, Director of the University of Florida Radio Observatory (UFRO) and the author are enlisting the cooperation of the scientific community in defining the system specifications. Some components, such as the receivers, will be standard "off-the shelf" items, hence will require little developmental research. However, others, such as the individual antenna elements, and the phasing and matching networks, will require some R&D to satisfy the frequency requirements (20 KHZ-40 MHZ).

By flying the experiment in Earth orbit first, Dr. Green proposes to gather valuable magnetospheric data as well as to prove the principle of the large moon based experiment. He claims that funding for the preliminary ground based studies at the UFRO may be available as early as FY 92. The author will co-write with Dr. Green and others a proposal to NASA to this effect.

II. ARCHIVING THE UNIVERSITY OF FLORIDA'S RADIO DATA AT THE NSSDC

Astronomers at the UFRO have synoptically monitored Jupiter's radio emission since 1957. They have the world's most extensive collection of such data. Starting in about 1975 they have also occasionally recorded Io-related decametric storms using a high-speed broadband recording system. They now desire to make these data available to the entire scientific community by archiving them with the NSSDC. When the author visited GSFC and NASA Headquarters on July 17, 1991, he discussed with Dr. Green how these data would be transferred to the NSSDC. Work to this end is now proceeding with an initial transfer expected by 9/1/92. They also discussed how the acoustooptic spectrograph currently

used at the UFRO could be upgraded to make future data more easily available to the NSSDC and how acoustooptic techniques could be used in the proposed lunar based magnetospheric sounder. Through contacts at the UAH the author had learned of Dr. Anthony Vanderlugt currently a professor at North Carolina State University who spearheaded the first acoustooptic research in the early 1970's. Dr. Vanderlugt offered to help in the design of a spacecraft acoustooptic spectrograph. An investigation of a broadband phasing technique known as a Rottman Lens was initiated.

III. THE NASA VISITING LECTURERS PROGRAM

The author and his colleague, Frank Six have both given many popular level talks on NASA's missions and the related science to public audiences. To expand this activity they have designed a "NASA Lecturer's Program" in which it is proposed that NASA will fund the travel of select NASA appointed lecturers to address university groups, schools, and public audiences. The plan is to make the lecturer's program available to JOVE institutions and public audiences in their areas on a 1-year trial basis. A JOVE university receiving a visiting lecturer would arrange for him/her to address a mix of college students, alumni, public school students, and service clubs in two or three lectures spanning two days and would agree to pay all local expenses.

The lecturers would be chosen for their ability to speak knowledgeably about NASA's missions and experiments and to excite audiences at all levels. The visiting lecturers program will not only educate but will inspire students to pursue scientific and technical careers and will awaken in the adults the awe and excitement of NASA's missions.

Dr. Ed Wells, professor, and Dr. Paul Smeyak, Chairman of the Telecommunications Department at the UF have both indicated enthusiastic interest in developing a series of five to seven minute NASA promotional video tapes for the visiting lecturer's program as class projects for their students. The UF's Telecommunication Department is one of the largest in the United States. The author will coordinate the preparation of these tapes.

IV. INTRODUCING MINORITY SCHOOLS TO SPACE GRANT CONSORTIA USING THE JOVE PROGRAM

In a recent visit to the UF, the author met with Dr. Harry Shaw, UF's Director of Minority Affairs, and Dr. Martin Eisenberg, Chairman for Aeronautical Engineering at the UF and Director of the Florida Space Grant Consortium. Each is interested in involving the UF with JOVE institutions. Dr. Eisenberg sees JOVE as a natural way to introduce Florida's smaller institutions to NASA research making them eligible as members in Florida's Space Grant Consortium and offering an opportunity for the major consortium members to serve as mentors in the JOVE program.

Should the UF serve as a mentor institution, through the JOVE program, it may collaborate with minority institutions thereby attracting good minority students into the UF's graduate programs. To that end, Dr. Shaw is putting together a list of minority school administrators who, with his guidance, may be convinced to apply for JOVE participation.

Dr. Charles MacGruder, a physics professor at Fisk University (a JOVE member institution in Nashville) and the author have discussed a joint research effort in which Dr. MacGruder's MS graduates could attend the UF to do their Ph.D. work in astrophysics. The author and others in the UF's Department of Astronomy share Dr. MacGruder's research interests (VLF radio propagation, astrophysics, radio astronomy). The author has also contacted faculty and administrators at Embry Riddle University in Daytona Beach, FL, and South Carolina State College in Orangeburg, SC and he plans to cultivate the interest of other institutions in the JOVE program with the UF potentially acting as the mentor institution.

V. METEOR/SHUTTLE PROGRAM

During his summer at MSFC, the author finished a paper entitled, "The First Multi-Frequency Observation of Decametric Radio Emission by a Meteor" which will be submitted to Icarus. He intends to propose a follow-on experiment to NASA in which appropriately placed radio receivers would monitor radio emissions from the re-entering shuttle as it penetrates the earth's atmosphere.

